# Vibration "transmitters" cost less than monitors...Fact or fiction?

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To remain competitive, companies that are considering expanding their operations are evaluating projects, based upon return on investment (ROI). The projects that provide the best ROI are the ones that are most likely to be accomplished. This focus on ROI has created a need to construct new facilities or expand existing ones for the lowest possible overall installed cost. Lowest overall installed cost can be defined as the cost of the equipment plus the cost to properly install it. In the machinery monitoring industry, the drive to reduce costs has increased the demand for vibration "transmitters." The assumption is that a device that replaces both the Proximitor® sensor and the vibration monitoring system (i.e. the rack) must cost less. This article is intended to help you understand that this assumption is not true when the overall cost to install each solution is taken into consideration.

## Need for machinery management

A few years ago, an experienced rotating machinery engineer told us, "If the Alert light is displayed on the front of a Bently monitor, then I'm not doing my job!" This is the premise of *proper* machinery management. Managing a machine *properly* means that those responsible for the machine are constantly aware of its condition. Accidentally allowing a machine to exceed an alarm setpoint is in direct violation of this general principle.

Proper machinery management means that, when the condition of a machine changes, enough machinery data is available to detect the change and to provide an accurate evaluation of the machine. Based upon the evaluation, action plans and business plans can be implemented to limit the amount of loss or process interruption caused by the change in the machine's condition.

What does this have to do with the cost of vibration "transmitters"? To manage a machine with vibration "transmitters," the dynamic transducer signal must be readily available. This signal should be input into an online condition monitoring system, such as Data Manager® 2000 for Windows NT™. A minimum requirement is that the dynamic transducer signals should be wired to an area in the facility where machinery engineers can easily access the signals, for example, a patch panel in the maintenance shop. A "transmitter," capable of providing the proper signal, requires more power than is available via the 4 - 20 mA loop provided by the control system (i.e., DCS, ESD, PES, etc.). Therefore, a three or four-wire vibration "transmitter" must be used. Bently Nevada's Relative Vibration Transmitor™ Unit (1800/15), for example, is a four-wire vibration "transmitter." Its maximum current draw is 45 mA, which

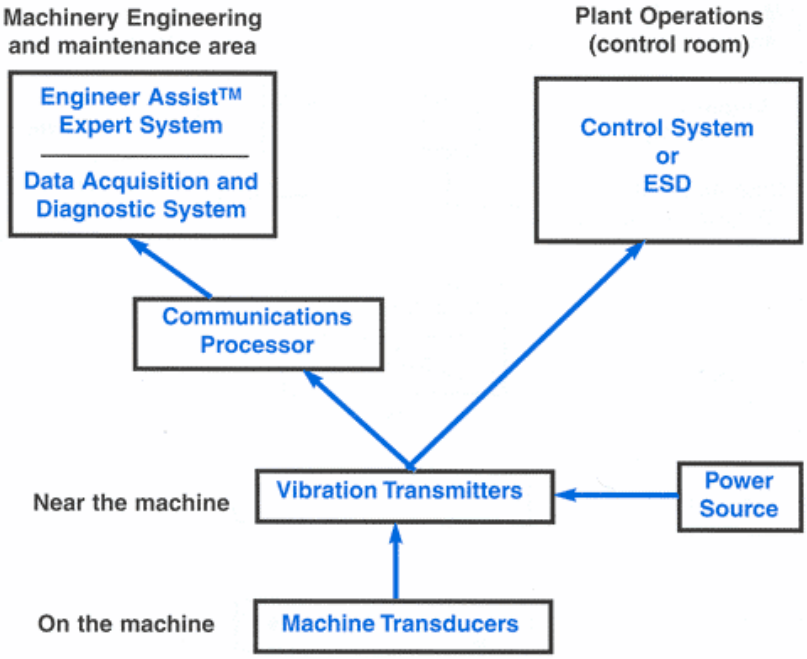


**Figure 1**
**Vibration "transmitter" - Machinery Management System Layout.**

is significantly more current than the 2 to 3 mA available from the control loop when a vibration "transmitter" is experiencing a Not OK condition.

A vibration "transmitter" used as part of a machinery management system requires that three different types of signals be connected to the vibration "transmitters." These signals are the analog output, the dynamic transducer signal output and the power input. Since vibration "transmitters" are installed where the Proximitor® is installed, i.e. next to the machine, all three of these signals will need to be connected by wires from the machine to the respective receiving devices (Figure 1).

In contrast, a machinery management system that uses a vibration monitoring system instead of vibration "transmitters" is a much simpler system. The only signals that need to be run from the machine are the dynamic transducer signal outputs from the Proximitor. Power for the Proximitor is provided by the vibration monitoring system. Therefore, a separate external power input is not required near the machine. The vibration monitoring system can also produce the 4-20 mA signal required by the control system (Figure 2).

*The installed cost of a vibration monitoring system is actually less than the installed cost of a vibration "transmitter" option because only one set of wires rather than three is required.*

The installed cost of a simple, loop-powered analog "transmitter" varies from project to project. However, a "transmitter" will cost approximately $2,000 to install. This includes field installation of the "transmitter," the interface cards in the control system and wiring between the "transmitter" and control room. In addition, it costs approximately $1000 per "transmitter" to program the control system with the correct logic to detect alarm conditions, "transmitter" fault conditions and to display the vibration value. Since vibration "transmitters" also have a dynamic signal output, the cost to run this signal from the vibration "transmitters," located near the machine, to the Machinery Engineer's work area must be included. Since this work area is usually not located in the same building as the control system, new wiring runs must be engineered. This may include installing additional conduit and cable trays. The cost to do this is an additional $1,000 per "transmitter," bringing the total installed cost per vibration "transmitter" to $4,000 per point.

Wiring costs are substantially lower for a typical vibration monitoring system. Only one set of wires connects the Proximitor, located near the machine, to the vibration monitoring system "rack," which is often located in the same building as the control system. Since the vibration monitoring system is often located near the control system, the cost to install wire between the vibration monitoring system and the control system is fairly low. Assuming that space is available in the control system building, the overall cost to install one point of vibration monitoring is approximately $3,000 per point. Unlike vibration "transmitters," vibration monitoring systems can detect alarm and fault conditions. Therefore, the cost to program the control system with the correct logic to detect alarm conditions and "transmitter" fault conditions can be eliminated. The control system only needs to be programmed to display vibration values, at approximately $400 per point.

Using a vibration monitoring system saves a substantial amount of money, as there is no need to install wiring from the machine's dynamic transducer to the Machinery Engineer's work area. The dynamic transducer signal is available at the vibration monitoring system in analog and digital form. The analog signals are available for connection to diagnostic equipment. The digital signals from many transducers can be carried by a single serial cable to the machinery management system located in the Machinery Engineer's work area. One serial cable costs much less to install than the many individual wires needed by a "transmitter" system, especially in typical installations where the serial cable is installed from the control building, not from the machine. This cost can be estimated at $100 per point. *This brings the total installed cost for a vibration monitoring system to $3,500 per point, $500 less than a vibration "transmitter."*

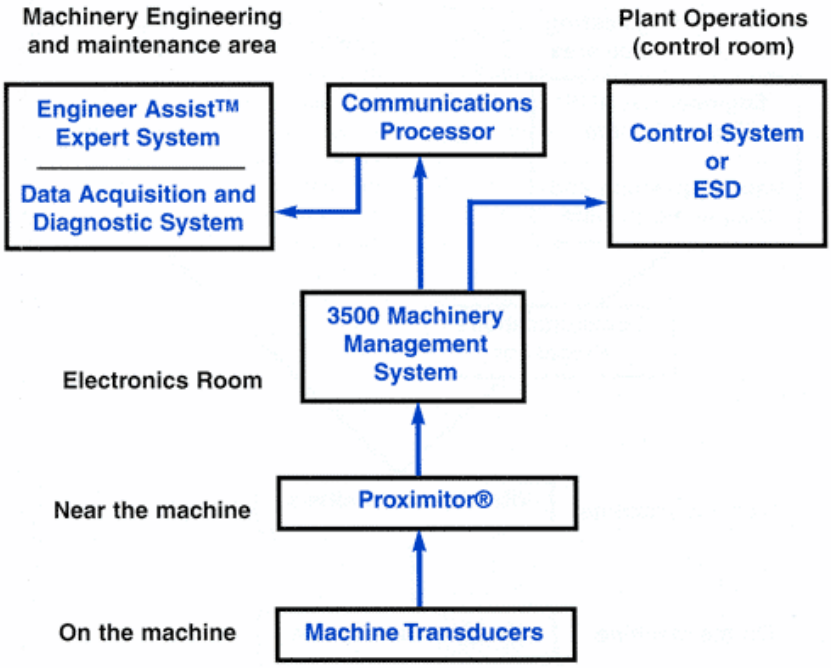


**Figure 2**
**Vibration Monitoring System - Machinery Management System Layout.**

### Typical installation costs

Bently Nevada's Design and Installation Services (D&IS) department developed an estimate of the cost to install each type of system. The scenario was for an ethylene expansion project that involved 98 points of vibration and thrust position measurements. The same length of wire runs were applied to both scenarios. The total Bently Nevada hardware cost for both systems differed by only $3000. This number was insignificant compared to the total installation cost Therefore, installation costs would determine which option actually had the lower installed cost.

The vibration "transmitter" option was estimated to cost 15% more to install than the vibration monitoring system. A D&IS project includes several different parts: design, project management, and mechanical and electrical work. Everything except the electrical portion was the same for both scenarios. Therefore, the system which had a higher cost for the electrical portion (installing wires, running conduit and cable trays) would be more expensive. The electrical portion of the vibration "transmitter" option was estimated to cost 42% more than the electrical portion of the vibration monitoring system's estimate. Obviously, these numbers can vary significantly from project to project, but a 42% difference is difficult to ignore. Therefore, the total cost of installing a monitoring system was significantly less.

### Conclusions

Conventional 2-wire current loop "transmitters" can only indicate changes in overall vibration amplitude. When this amplitude changes, there is no information available that can assist with determining the cause of the change. Systems designed with an architecture similar to the 2-wire approach, but with dynamic data capability, such as the Bently Nevada 1800 Dymanic Transmitor™ Unit, appear to take advantage of lower installation costs, but they really do not. The truth is, the user is left with a system that can provide access to the dynamic transducer signal; however, all other monitoring functions are lost. For less total cost, A Bently Nevada 3500 Machinery Management System, complete with a properly installed Data Manager® 2000 online condition monitoring system, can be installed. This provides a user with complete dynamic data in addition to full protection, using relays and traditional analog or advanced digital communications to third party control systems.■

*Editor's Note: The installed cost comparisons outlined in this article address typical conventional installations. The 3500 Monitoring System can also be located next to your machines, minimizing wiring costs, which is the new industry paradigm. The reduction in wiring costs can be enormous, as individual cables don't need to be run from each Proximitor to the control room. The only required wiring is the Serial Data link to the control room (an information-rich interface which provides necessary information to operators, replacing the traditional individual 4-20 mA signals), the Dynamic Data link, which provides necessary diagnostic information, and the relay contact signals. Such installations can reduce costs by up to 30% over a conventional installation where the monitor "rack" is installed in a control room.*

## Why Bently Nevada decided to manufacture "transmitters"

***by Steve Riggs***
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Bently Nevada has always strived to carefully listen to you, our customers, so we could understand your real needs and develop new products that addressed your needs. As long as our new products helped you solve your problems in a cost-effective manner, we were both successful. Occasionally, you told us you wanted new products from Bently Nevada, but you were not able to explain, or we did not understand, your real need. We are always uncomfortable in this situation, as it represents a major source of conflict for us. If we don't do as you ask, we risk losing our most valuable asset, our relationship with you, our customers. If we do as you ask, but do not understand your real need, we have become, in essence, a contract design and manufacturing firm. However, that is contrary to our culture of understanding our customers' businesses well enough to be a "partner" in their operations.

Most often, we err on the side of keeping the customer relationship, primarily because, unless we do so, we will never be in a position to understand what the real business issues are. This is exactly what happened in the case of the development of the 1800 Dynamic Transmitor®System. One of our long-standing, and highly-valued, customers approached us with a product idea: to develop a Proximitor-like device which would output a 4-20 mA signal, proportional to overall vibration amplitude, as its only output. We did not think this was a good idea for either machinery protection or management, but couldn't convince our customer. Our customer told us, "This is the product we want. We want Bently Nevada to build it because we know from thirty years of experience working with your company that, if you build it, it will work. It will also be supported worldwide by your service organization. However, if you elect not to build it, we will find another organization who will."

We were in a very difficult position. We elected to stay with the customer to preserve our relationship, even though we did not clearly understand what the real need was. We are glad that we decided to stay close to our customer. It allowed us to better understand the customer's real need. This understanding enabled us to develop a quality product which does solve our customers' problems, the 3500 Machinery Management System.■